Malaria

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

There are four *Plasmodium* species (sporozoan parasites) that commonly cause malaria in humans. They are *Plasmodium vivax*, *P. malariae*, *P. ovale* and *P. falciparum*.

B. Clinical Description

The classic symptoms of malaria are high fever with chills, sweats, and headache, which may be paroxysmal (involving recurrence or intensification of symptoms). The fever and paroxysms generally occur in a cyclic pattern. Depending on the infecting species, fever may appear every other or every third day. Other symptoms can include malaise, nausea, vomiting, diarrhea, cough, arthralgia (joint aches), respiratory distress and abdominal and back pain. Pallor and jaundice may also be present. Enlargement of the liver and spleen (hepatosplenomegaly) may occur and is more prominent in chronic infections. Infection with *P. falciparum* is potentially fatal and most commonly manifests as a febrile illness without specific or localizing signs. Falciparum malaria may present with coagulation defects, shock, renal and liver failure, acute encephalopathy, pulmonary and cerebral edema, and coma. The case-fatality rate is 10–40% in the absence of prompt treatment. The duration of an untreated primary attack can vary from a week to a month or longer. Relapses of *P. vivax* and *P. ovale* infections can occur at irregular intervals for up to 5 years. Malaria infections may persist for life (chronic infections), with or without recurrent episodes of fever.

C. Reservoirs

Humans are the only important reservoir of human malaria. Non-human primates are naturally infected by many malarial species that can potentially infect humans, but natural transmission from non-human primates to humans is extremely rare.

D. Modes of Transmission

Malaria is transmitted by the bite of an infective female *Anopheles* mosquito. Transmission can also rarely be congenital (via the placenta) and can occur through transfusions or the use of contaminated needles.

E. Incubation Period

The time between the infective bite and the appearance of clinical symptoms is approximately 7–14 days for *P. falciparum*, 8–14 days for *P. vivax* and *P. ovale*, and 7–30 days for *P. malariae*. With some strains of *P. vivax*, mostly from temperate areas, there may be a prolonged incubation period of 8–10 months; even longer incubations may occur with *P. ovale*. With infections acquired by blood transfusion, the incubation period depends on the number of parasites infused; it is usually short, but may range up to 2 months.

F. Period of Communicability or Infectious Period

Malaria is not directly communicable from person-to-person except for congenital transmission; however, during parasitemia, the disease may be transmitted to other persons through blood transfusion or through shared contaminated needles. Infected human hosts remain infectious for *Anopheles* mosquitoes for prolonged periods of time (1–3 years, or longer, depending on the species) if they are not adequately treated.

G. Epidemiology

Malaria is endemic throughout the tropical areas of the world. About half of the world's population lives in areas where transmission occurs. Areas with the highest prevalence include sub-Saharan Africa, parts of

Central and South America, India, and parts of Oceania and Southeast Asia. Transmission is also possible in more temperate climates such as in the United States, where *Anopheles* mosquitoes are present. Mosquitoes in airplanes flying from tropical climates have been the source of occasional cases in persons working or living near international airports. However, nearly all of the malaria cases reported annually in the United States (~1000) are acquired abroad. *P. vivax* and *P. falciparum* are the most common species worldwide. The worldwide spread of strains of chloroquine-resistant *P. falciparum* and *P. vivax* is of increasing importance. Resistance to other antimalarial drugs is now occurring in many areas where the drugs are widely used.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- Report a laboratory-confirmed case in any person diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country. A laboratory-confirmed case is the demonstration of malaria parasites in blood on microscopic examination**.**

Note: See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

The Massachusetts State Laboratory Institute (SLI) does not perform testing for malaria. Testing is either performed at private laboratories or at the Centers for Disease Control and Prevention (CDC). The CDC conducts testing for malaria by serologic tests only under special circumstances (*e.g.*, serum of a blood donor suspected of being a source of transfusion-related malaria or serum for laboratories conducting malaria-related studies) or with prior approval. For approval for serologic testing, the Parasitology Branch at CDC should be called at (770) 488-7760 before contacting the SLI, Reference Laboratory. Healthcare providers may send thick or thin blood smears to the SLI, Reference Laboratory which will in turn send the specimens to the appropriate laboratory at CDC. Call the Reference Laboratory at (617) 983-6607 before submitting specimens.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify imported cases of malaria.
- To ensure that cases are appropriately contained and treated to prevent the introduction of malarial parasites into native mosquito populations.
- To identify locally acquired cases, if they occur, so appropriate active surveillance and mosquito control interventions can be implemented.
- To provide travelers with appropriate preventive health information.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the lists of reportable diseases (at the end of this manual's Introduction) for information.

C. Local Board of Health Responsibilities

1. **Reporting Requirements**

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of malaria, as defined by the reporting criteria in Section 2) A. Current requirements are that cases be reported to the MDPH Division of Epidemiology and Immunization, Surveillance Program using an official CDC *Malaria Case Surveillance Report* form (in Appendix A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. **Case Investigation**
   a. It is the LBOH responsibility to complete a CDC *Malaria Case Surveillance Report* form (in Appendix A) by interviewing the case and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the case's healthcare provider or the medical record.

   b. Use the following guidelines to assist you in completing the form:
      1) Accurately record the demographic information, date of symptom onset, pregnancy status, healthcare provider information, and whether hospitalized (including location and associated dates).
      2) Accurately record laboratory results, particularly the species of malaria, and the laboratory that performed the testing.
      3) Record information about whether and where the case has spent time out of the country in the past four years, including duration of stay and date returned.
      4) Indicate whether the case took malaria prophylaxis and, if so, what kind.
      5) Record whether the case has had a history of malaria within the past 12 months.
      6) Record whether the case has had a blood transfusion within the past 12 months. *Note:* If the patient is a recent blood donor, this information should be provided to the Surveillance Program as soon as possible so CDC and other appropriate agencies can be notified.
      7) Be sure to record all clinical complications and whether the illness was fatal.
      8) Indicate which therapy was given for this illness.

      There is a "Continuation" section on the back of the form which can be used to document other relevant aspects of the investigation that are not captured elsewhere on the form (*e.g.,* other risk information such as recent history of injection drug use or perinatal transmission, history of malaria prior to the last 12 months, any medical care received abroad.)

   c. If you have made several attempts to obtain case information, but have been unsuccessful (*e.g.*, the case or healthcare provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely.

   d. After completing the form, attach lab report(s) and mail (in an envelope marked "Confidential") to the MDPH Division of Epidemiology and Immunization, Surveillance Program. The mailing address is:
      MDPH, Division of Epidemiology and Immunization
      Surveillance Program, Room 241
      305 South Street
      Jamaica Plain, MA 02130

   e. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4), Controlling Further Spread.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

Minimum Period of Isolation of Patient
No restrictions except for exclusion from blood donation.

Minimum Period of Quarantine of Contacts
No restrictions.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Locally Acquired Case

A locally acquired case of malaria is possible but would be unusual (malaria vectors are in Massachusetts but not dense). If you determine during the course of an investigation that a case does not have a recent travel history to an endemic country, measures such as investigating local areas visited by the case to locate the focus of infection and surveillance of other people for illness may be necessary. Contact the epidemiologist on-call at the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850.

Reported Incidence Is Higher than Usual/Outbreak Suspected

If the number of reported cases of malaria in your city/town is higher than usual, or if you suspect an outbreak, investigate to determine the source of infection and mode of transmission. Consult with the epidemiologist on-call at the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several town lines and therefore be difficult to identify at a local level.

D. Preventive Measures

International Travel

- People traveling to malaria-endemic parts of the world should be notified of their risk of contracting the disease and control measures they can take to protect themselves from mosquitoes. Travelers can use repellents, wear protective clothing and use mosquito nets when rooms are not screened.
- Detailed recommendations for preventing malaria are available 24 hours a day from the CDC Malaria Hotline, which can be accessed by telephone at (770) 488-7788, by fax at (888) CDC-FAXX or (888) 232-3299, or CDC's website at <http://www.cdc.gov/travel>.
- Travelers and recent immigrants from malaria-endemic regions with symptoms suggestive of malaria should be referred to a healthcare provider for prompt testing and treatment. Failure to treat individuals with malaria could lead to their becoming a local source of malaria transmission to mosquitoes if bitten, then to other people bitten by those mosquitoes. This is extremely rare and to MDPH knowledge has never occurred in Massachusetts, but it is possible.

ADDITIONAL INFORMATION

The formal CDC surveillance case definition for malaria is the same as the criteria outlined in Section 2) A. (CDC case definitions are used by the state health department and CDC to maintain uniform standards for national reporting.) For reporting a case to the MDPH, always refer to the criteria in Section 2) A.

REFERENCES

American Academy of Pediatrics. *1997 Red Book: Report of the Committee on Infectious Diseases, 24th Edition*. Illinois, American Academy of Pediatrics, 1997.

CDC. Case Definitions for Infectious Conditions Under Public Health Surveillance, *MMWR*. 1997; 46:RR-10.

CDC Website. Regional Malaria Information. Available at <http://cdc.gov/travel/regionalmalaria>. Updated September 1998.

Chin, J., ed. *Control of Communicable Diseases Manual, 17th Edition*. Washington, DC, American Public Health Association, 2000.

MDPH. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*. MDPH, Promulgated November 1998, (Printed July 1999).